

Notice of Allowability

Applicant No.

09/558,053

Examiner

Julio J. Maldonado

Applicant(s)

APYAMA ET AL.

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1306.

1. ☒ This communication is responsive to response filed on 09/08/2003.
 2. ☒ The allowed claim(s) is/are 29-33 and 35-40.
 3. ☒ The drawings filed on 26 April 2003 are accepted by the Examiner.
 4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
- * Certified copies not received: _____
5. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 - (a) ☐ The translation of the foreign language provisional application has been received.
 6. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. **THIS THREE-MONTH PERIOD IS NOT EXTENDABLE**

7. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
8. ☐ CORRECTED DRAWINGS must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No. _____.
 - (b) ☐ including changes required by the proposed drawing correction filed _____, which has been approved by the Examiner.
 - (c) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet.

9. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|---|
| 1 <input type="checkbox"/> Notice of References Cited (PTO-892) | 2 <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3 <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 4 <input type="checkbox"/> Interview Summary (PTO-413), Paper No. _____ |
| 5 <input type="checkbox"/> Information Disclosure Statements (PTO-1449), Paper No. _____ | 6 <input type="checkbox"/> Examiner's Amendment/Comment |
| 7 <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material | 8 <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9 <input type="checkbox"/> Other |

DETAILED ACTION

1. The final rejection as set forth in paper mailed on 06/03/2003 is withdrawn in response to applicants' request for reconsideration.
2. Claims 29-33 and 35-40 are pending in the application.

Allowable Subject Matter

3. Claims 29-33 and 35-40 are allowed.
4. The following is an examiner's statement of reasons for allowance:

The prior art of record, Chow et al. to U.S. 4,789,648 teach in Figs.2-6 and related text, a method to form an interconnect structure teach the steps of forming a first insulating film (5) on a semiconductor substrate (2); forming a second insulating film (6) on said first insulating film (5), said second insulating film (6) being made of a material different from that of the first insulating film (5) and having a thickness smaller than that of the first insulating film (5); forming a third insulating film (8) on said second insulating film (6), said third insulating film (8) being made of a material different from that of the second insulating film (6) and having a thickness larger than that of the second insulating film (6); forming a groove (7) in a region of said third insulating film (8), in which a wiring is to be formed, said groove having a bottom to which said second insulating film (6) is exposed; removing a part of that portion of the second insulating film (6) which is exposed to the groove (7), and part of the first insulating film (5) under the portion of the second insulating film (8), and thus a contact hole reaching to the semiconductor substrate (2); and burying the groove (7) and the contact hole with a

copper alloy (9) to form a wiring in said groove (7) and a contact in said contact hole (column 2, line 67 – column 4, line 35).

Chow et al. fail to teach the step of removing the second and first insulating film using the same etching mask, wherein said mask is formed on said third insulating film and in another part of said portion of the second insulating film which is exposed to the groove; and controlling the deposition of copper to avoid formation of a native oxide.

Mo to U.S. 4,764,484 teaches in Figs.1-6 and related text, a method to form interconnects including the steps of forming a first insulating film (10) on a semiconductor substrate (12); forming a second film (16) on the first insulating film (10), said second film being made from a semiconductor material and having a thickness smaller than that of the first insulating film (10); forming a third insulating film (18) on said second film (16), said third insulating film (18) being made from a material different from that of the second film (16) having a thickness larger than that of the second film (16); forming a groove (22) in a region of said third insulating film (18), in which a wiring is to be formed, said groove having a bottom; removing a part of the second film (16) and a part of the first insulating film (10) under the portion of the second film (16), and thus forming a contact hole (26) reaching to the semiconductor substrate (12); and forming a conductive material (28) in the groove (26) (column 2, line 11 – column 3, line 25).

However, Mo fails to teach forming a second insulating film; forming a groove in a region of said third insulating film, said groove having a bottom to which said second insulating film is exposed; removing a part of that portion of the second insulating film

which is exposed to the groove; and burying the groove and the contact hole with copper to form a copper wiring in said groove and a copper contact in said contact hole, and controlling said burying with said copper to avoid formation of a native oxide.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

5. Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 305-3432**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via julio.maldonado@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.

Application/Control Number: 09/558,053
Art Unit: 2823

Page 5

JMR
9/25/03


George Fourson
Primary Examiner